Question 7.

(i) Find the projection of $\vec{a}$ on $\vec{b}$ if $\vec{a} \cdot \vec{b} = 8$ and $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$

(ii) Find the projection of $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $2\hat{i} - 3\hat{j} + 6\hat{k}$.

(iii) Find the projection of $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$

(iv) Find $\lambda$ when the projection of $\hat{i} + \lambda\hat{j} + \hat{k}$ on $\hat{i} + \hat{j}$ is $\sqrt{2}$ units.

$\hat{b} \rightarrow$ Unit vector.

Projection of $\vec{a}$ on $\vec{b}$ $= \vec{a} \cdot \hat{b} = \vec{a} \cdot \dfrac{\vec{b}}{|\vec{b}|}$

$\vec{a} \cdot \vec{b} = 8 \qquad \vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$

$|\vec{b}| = \sqrt{4 + 36 + 9} = \sqrt{49} = 7$

Projection of $\vec{a}$ on $\vec{b} = \dfrac{\vec{a} \cdot \vec{b}}{|\vec{b}|} = \boxed{\dfrac{8}{7}}$

$\vec{a} = \hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $\vec{b} = 2\hat{i} - 3\hat{j} + 6\hat{k}$

Projection of the vector $\vec{a}$ on $\vec{b}$ $= \vec{a} \cdot \hat{b} = \dfrac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$

$$\vec{a} \cdot \vec{b} = (\hat{i} + 3\hat{j} + 7\hat{k}) \cdot (2\hat{i} - 3\hat{j} + 6\hat{k})$$

$$= (2 - 9 + 42)$$

$$\vec{a} \cdot \vec{b} = (44 - 9) = 35$$

$$|\vec{b}| = \sqrt{4 + 9 + 36} = \sqrt{49} = 7$$

Projection of the vector $\vec{a}$ on $\vec{b} = \dfrac{\vec{a} \cdot \vec{b}}{|\vec{b}|} = \dfrac{35}{7} = 5$

$\hat{i}-\hat{j}$ on the $\hat{i}+\hat{j}$

$\vec{a} = \hat{i}-\hat{j} \quad \vec{b} = \hat{i}+\hat{j}$

$\vec{a}\cdot\vec{b} = 1-1 = 0$

projection of $\vec{a}$ on $\vec{b} = \frac{\vec{a}\cdot\vec{b}}{|\vec{b}|} = \frac{0}{\sqrt{2}} = 0$

$\hat{i}+\lambda\hat{j}+\hat{k}$ on $\hat{i}+\hat{j}$ is $\sqrt{2}$ Unit

but

$\vec{a}=\hat{i}+\lambda\hat{j}+\hat{k}$ $\quad \vec{b}=\hat{i}+\hat{j}$

Projection of vector $\vec{a}$ on $\vec{b}=\dfrac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$

$\vec{a}\cdot\vec{b}=1+\lambda+0$

$|\vec{b}|=\sqrt{2}$

$$\sqrt{2}=\frac{1+\lambda}{\sqrt{2}}$$

$$2=1+\lambda$$

$$\boxed{\lambda=1}$$